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ROCKY MOUNTAIN BEES. IV[1]

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THE GENUS *NOMADA*

The bees of the parasitic genus *Nomada* discussed in the following pages all belong to the collection of The American Museum of Natural History, and the types of new species described herein are deposited in that institution. I should like to express my gratitude to the American Museum for the privilege of studying this collection, and more especially to Professor T. D. A. Cockerell, of the University of Colorado, without whose kindly encouragement and assistance this study would never have been begun.

NOMADA

GNATHIAS Robertson

With bidentate mandibles.

MALES

1.—Abdomen with entire or narrowly interrupted yellow or cream-colored bands, usually at least on tergites 2 and 3, sometimes (*leucozona*) on 2 only; slightly larger.....2.

Abdomen dark red without bands, but usually with spots at lateral margins of tergites 2, 3, and 4, the last sometimes small and obscure; small.
lepida cuneata (Robertson).

2.—Second abdominal tergite with an ivory-white, continuous band, narrowed medially; first tergite with two inconspicuous white lateral spots, third with two white lateral marks pointed mesad, very close to posterior margin of second tergite; 9 mm.....*leucozona*, new species.

Mesothorax black; slightly interrupted yellow or yellowish bands on tergites 2 and 3, frequently also on 1, and on 4–6. Size variable....*lepida* Cresson.

FEMALES

1.—Abdomen without yellow markings but with narrow black bands at base of tergites 2–4 and a W-shaped mark at base of first segment. Face with a large black area involving ocelli, front, and antennal fossæ, and extending downward on either side of clypeus, leaving only lateral face-marks, clypeus, and a small isolated supraclypeal spot red. 8 mm.....*orophila* Cockerell, variety.

[1]Nos. I to III of this series appeared in American Museum Novitates Nos. 433, 458, and 490, respectively.

Abdomen with light lateral spots at least on second segment. Black on face around antennæ always separated from that around ocelli by red.....2.

2.—No black whatever around antennal insertions. The only black on the head is a small patch between the ocelli, and at extreme posterior of the head capsule. Only a tiny black spot on propodeum, and none whatever at base of abdomen, dorsally or ventrally. A brilliant sublateral yellow spot on either side of segment 2. Joints 3 and 4 of antennæ subequal. Third cubital cell as broad above as second. Robust. 7+ mm.....*carolinæ* Cockerell, variety.

At least a little black around antennal insertions and at base of first abdominal segment.....3.

3.—Second cubital cell very broad above, practically square. Third about as broad below as the second is above, but narrowed at the top almost to a point. Lateral spot on second abdominal segment bright cream-colored. Ocelli transparent, colorless, prominent, 8 mm....*heterosticta* Cockerell, variety.

Second cubital narrowed above more or less, the third not nearly produced to a point above. Lateral spot on second abdominal segment yellow.....4.

4.—Light spots on second abdominal segment only. Basal nervure basad of nervulus a distance less than the length of the latter. Third cubital about as wide above as the second. Head and thorax with considerable black. 9.5 mm. *lepida* Cresson.

Small light spots on third abdominal segment as well as on second. Basal nervure far basad of nervulus. Third cubital cell about half as wide above as the second. Less black on head and thorax. 7 mm...*lepida cuneata* (Robertson).

Nomada (Gnathias) lepida Cresson

COLORADO.—Boulder, April 26 and April 28, 1913, two males (Ellis). Plainview to Eldorado Springs, May 22, 1921, one female (Jackson).

One of the males is typical *lepida* as described by Cresson. The other is larger and possibly comes nearer to *bella*, but I leave it here for the present.

The female is undoubtedly *lepida*, showing the peculiar markings at each side of the base of the first abdominal segment which seem to be a rather constant character in the females of this species.

Nomada (Gnathias) lepida cuneata (Robertson)

COLORADO.—Boulder, June 6, 1922, 24 males, one female (F. E. Lutz).

In view of the observations of Cockerell and Swenk on the identity of *lepida* Cresson and *cuneata* Robertson, I refer these specimens here. They are, however, so different from the typical *lepida* that I have seen from this district that I feel compelled to employ the trinomial to perpetuate in the literature records which may be of importance in the future study of this variable, if not composite, group. Until more is known of the host relations and general biology of the genus *Nomada*, excessive

lumping of forms will serve only to obscure biological facts which may prove to be of great importance.

The only female specimen is lacking both flagella and the right anterior wing. The males are variable, from 6 to 8 mm. in length. In abdominal markings they vary from 8-spotted to 4-spotted. The scutellar lobes vary from confluently red to red-spotted to black, and the scape is yellow in front in some, ferruginous in others, and in one is entirely black.

Nomada (Gnathias) carolinæ Cockerell variety

WYOMING.—Jackson, July 13–17, 1920, alt. about 6600 ft. (F. E. Lutz).

This specimen has no black whatever on the face around the antennæ and likewise none whatever at the base of the abdomen, dorsally or ventrally. The propodeum has only a tiny spot of black at the posterior point of the enclosed area medially. The only dark marks on the legs are on the bases of the coxæ behind. The date of collection, however, would seem to be rather late for *carolinæ*. A specimen from Texas is mentioned by Swenk as being taken on March 20, 1907, and a male from Virginia on May 9 (1907?). According to the same author, the species flies in Nebraska from April 13 to May 17, and one was taken in North Dakota on May 8, 1912. (The type, from North Carolina, was apparently not dated.) It is reasonable to believe that perhaps the later season at Jackson (43° 30′ N., 110° 16′ W., altitude 6600 feet) might cause its appearance there in July.

Nomada (Gnathias) heterosticta Cockerell variety

IDAHO.—Victor, July 11, 1920, alt. about 6300 ft., one female (Mrs. F. E. Lutz).

Lacks the "small black spot at each side of third segment near base," the area between the antennæ is definitely black, the femora have considerable black basally, there is black at base of abdomen above and below. The black at base of venter of the first abdominal segment is "like a fish tail, with sharp points," as is given by Cockerell for his *perplexa* variety from Wyoming, but the venation is considerably different from a Virginia specimen of male *perplexa*, the color is much lighter, the face is slightly wider, the antennal proportions are not similar, the ocelli (if they are of any value in separating species) are lighter in color, the eyes (in the dried specimen) are purple instead of fuscous, etc. In view of the very distinctive venation I think it best to leave it as a variety of *heterosticta*, separable on the basis of the characters listed above, especially since it is one of the same lot of insects as the type of *heterosticta*, taken at the same locality and at the same time.

Nomada (Gnathias) orophila Cockerell variety

WYOMING.—Stewart Ranger Station, near Jackson, July 18, 1920, alt. about 6700 ft., one female (Mrs. F. E. Lutz).

Differs from true *orophila* female (as described) in having extremely scanty hair on head and thorax, that on thorax and scutellum not "strongly reddish"; face with yellowish suffusions at lower corners; the black bands passing downward from each antenna joined over the supraclypeal area, except for an obscure red spot above the clypeus; eyes slightly plum-colored; first joint of flagellum (second antennal joint) dark basally; mesothorax with the median black band but without the lateral ones; hind femora with a black stripe behind extending nearly to the apex; abdomen with no yellow spots whatever; basitarsi strongly dusky. Other striking characters not specifically mentioned in the original description of the female, but which are found on the present specimen, are: narrow black bands at bases of abdominal tergites 2, 3, and 4, as in the male; heavy black W-shaped mark at base of first abdominal segment.

I have not seen a specimen of female *orophila* but after comparison with the male I place this specimen here without much hesitation. The types of *orophila* were taken June 20, 1920, while the present insect was found a month later, on July 18, 1920.

Nomada (Gnathias) leucozona, new species

COLORADO.—Boulder, April 14, 1931, at *Salix* (Pauline Lundy).

MALE.—Head and thorax dark, with grayish-white pubescence; abdomen red with one white band.

Length, 9 mm. Head and thorax mahogany-red with much black, closely and rather coarsely punctured. Ivory-white markings as follows: mandibles except tips; labrum; clypeus except narrowly above; lateral face-marks ending in a suffused point about half-way up anterior orbits; beneath eyes narrowly and a narrow suffused stripe up posterior orbits; a small spot (somewhat suffused reddish) at summit of each eye; an inconspicuous transverse mark on collar; and a suggestion of light spots on summits of scutellar lobes. Black as follows: about antennæ with a line downward from each insertion to lateral clypeal margins; front; ocellar region; occiput; most of prothorax except dorsally; a median stripe on mesothorax and two narrow lateral stripes failing posteriorly; pleuræ immediately beneath wings and a broad stripe from wings to middle and hind coxæ; all of metathorax except two lateral red spots not entering enclosure. Tubercles orange. Thick grayish-white pubescence on head and thorax. Mandibles bidentate, apical third black. Scutellum prominent, moderately bilobed. Antennæ dark ferruginous; scape somewhat blackened behind; flagellum dark behind, especially basally; apical joint somewhat pointed; third antennal joint a little shorter than fourth. Tegulæ orange, punctured but shining. Basal nervure far basad of nervulus; second cubital cell not narrowed greatly above and

receiving the first recurrent about at middle of base; third cubital greatly narrowed above, its outer margin strongly bent; receives second recurrent at about two-thirds of the distance along the base; wings iridescent, clear, strongly clouded at extreme apical margin; stigma and nervures fuscous. Legs dark red; coxæ blackish except at apex; trochanters red; anterior femora black at extreme base behind; middle femora with nearly basal half black behind; hind femora entirely blackish except at apex; tibiæ red except posterior pair very slightly suffused darkish behind; tarsi red; legs with rather abundant grayish hair. Abdomen darkish red, finely punctured and shining. Basal half of first dorsal segment black straight across, the apical margin of the tergite narrowly black, most noticeable near lateral margins; second tergite very slightly darkened postero-laterally. Ivory-white marks as follows: two small lateral spots on first tergite at posterior margin of the black; a broad band on second tergite, narrowed medially and almost interrupted minutely by small anterior and posterior emarginations on the median line; third tergite with two large cuneate marks laterally, almost hidden by the retraction of the segment; fifth tergite with a suggestion of white at the extreme apical margin. Abdominal segments with grayish-white hair near apical margins. Venter of abdomen red, except a blackish stripe on sternites 1 and 2, and a light spot at extreme apex of last ventral segment; base of first sternite with a black V-shaped mark. Apex red like abdomen, punctured, conspicuously notched.

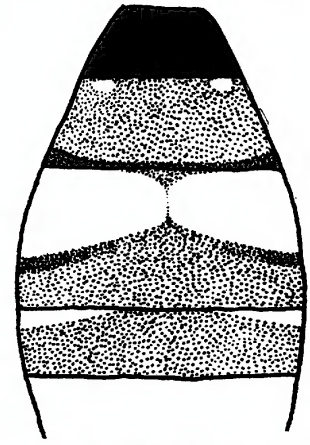

Fig. 1. Color pattern of first three abdominal tergites of *Nomada leucozona*, new species (diagrammatic).

This species is near *N. albofasciata* Smith, but differs from it by the larger size, head and thorax red and black, first abdominal segment without an interrupted fascia but with small inconspicuous lateral spots, hair of the head and thorax copious, scape red in front, scutellum red.

NOMADULA Cockerell

Male antennæ peculiar, anterior coxæ strongly spined, abdomen strongly punctured, the two sexes quite differently colored.

MALES

1.—Joint 4 of antennæ at least twice as long as 3, narrow, deformed along lateral edge; joint 5 toothed. Abdomen almost black with cream bands, that on tergite 1 usually interrupted. Apical plate very dark brown-red, edged with blackish. Pleural yellow spot inconspicuous. Hind surface of posterior femora red with blackish suffusion basally, sometimes with narrow blackish line. *scita* Cresson.

Joint 4 of antennæ not or hardly twice as long as 3, usually conspicuously less, more robust; joints 5–13 toothed beneath. Abdomen dark reddish-black

with cream bands. Apical plate usually bright ferruginous, long, narrow. Pleural yellow spot large. Hind surface of posterior femora uniformly suffused with blackish..... *semiscita* Cockerell.

Nomada (Nomadula) erythrochroa Cockerell

IDAHO.—Montpelier, July 6, 1920, one female (F. E. Lutz).

This species has been previously reported only from Washington State. Differs from the description in having a little black between ocelli, just behind wings, at base of hind coxæ behind, and at base of first abdominal tergite.

Nomada (Nomadula) scita Cresson

COLORADO.—Boulder, May 29, 1913, four males (Ellis), May 25, June 4 and 7, 1922, five males (F. E. Lutz). Elbert, June 9–11, 1922, one male (F. E. Lutz).

These vary in size from about 7 mm. to nearly 10 mm.

Nomada (Nomadula) semiscita Cockerell

COLORADO.—Boulder, May 29, 1913 one male (Ellis). Semper, May 25, 1919, two males (Jackson). Boulder, May 25 and June 7, 1922, three males (F. E. Lutz). Elbert, June 9–11, 1922, one male (F. E. Lutz).

These specimens are uniformly about 10 mm. long, with the exception of one (Semper, Colorado), which is about 8 mm. It is of interest to note the fact that both *scita* and *semiscita* are so frequently captured in company with each other. This may be due to the fact that their close relationship implies similarity in habitat, season, etc. It is conceivable that they represent variations or genetic modifications of the same species, but in this case it might be reasonable to except more intermediate forms than seem to have been found.

MICRONOMADA Cockerell

Anterior coxæ spined, antennæ ordinary, antennal joint 3 longer than 4, abdomen strongly punctured, apex of male usually notched.

MALES

About 10 mm. Punctures of head and thorax widely separated on a shining ground. Posterior margins of abdominal segments conspicuously impunctate, shining. Second cubital cell broader than tall, third narrowed above to less than one-fourth its basal breadth. Wings very dark..... *putnami* Cresson.

About 9 mm. Less robust. Punctures of head and thorax much more dense, although not subcancellate. Posterior margins of abdominal segments less conspicuously impunctate. Second cubital as tall as, or taller than, broad. Third not so much narrowed above. Wings ordinary..... *modesta* Cresson.

Nomada (Micronomada) putnami Cresson

COLORADO.—Colorado Springs, June 15–30, 1896, two males, one female (Wickham).

A female in Professor Cockerell's collection was compared and differed from the present specimen in having the third cubital narrowed only about one-half above, the wings blackish rather than reddish, the legs darker red (but with the same yellow marks), and the whole insect more blackish (reddish-black in the present insect). Professor Cockerell's specimen was from Boulder County, Colorado. The two males seem to be ordinary.

Nomada (Micronomada) modesta Cresson

COLORADO.—Eldorado Springs, June 23, 1918, one male (Jackson). Boulder, June 30, 1922, one male (F. E. Lutz).

On comparison with a male in Professor Cockerell's collection which has the apex black, it was found that one of these has the apex bright ferruginous, and the other is intermediate, having it a very dark red.

HOLONOMADA Robertson

Apical plate of male abdomen entire, antennal joint 3 of male longer than 4, mandibles simple, anterior coxæ not spined.

MALES

About 8.5 mm. Mesothorax wholly black; apex entire, slightly truncate, color a dark chocolate; apical margin of tergite 6 dark, almost black..... *vincta* Say.

About 10 mm. Mesothorax yellow at lateral margins; apex sometimes very slightly notched, sometimes entire, truncate, color lemon-yellow; apical margin of tergite 6 light ferruginous..... *zebrata* Cresson.

Nomada (Holonomada) vincta Say

COLORADO.—Canfield, August 15, 1922, one male (F. E. Lutz).

See discussion of *N. zebrata*.

Nomada (Holonomada) zebrata Cresson

COLORADO.—Canfield, August 15, 1922, two males (F. E. Lutz).

One of these males is typical *zebrata* as defined in the literature and as represented in my collection and in that of Professor Cockerell. The other seems fairly intermediate between this species and *vincta*. The proportions of the scutellum and postscutellum are those of *zebrata*. There is a faint suggestion of yellow lateral mesothoracic marks as in *zebrata*. But the color of the apical margin of the sixth abdominal tergite and of the apical plate is like that of *vincta*. All of the specimens of

vincta and *zebrata* I have seen, with the exception of this one, are separable on the basis of this character, which seems to be fairly constant. Perhaps this is another instance of the possibility of hybridization between two very closely allied forms, or perhaps it represents an intermediate between two usually distinct varieties of the same species.

A specimen of *vincta heterochroa* Cockerell in Professor Cockerell's collection has the apex colored nearly as in *zebrata*, and it is very slightly notched, which might indicate a closer relationship to *zebrata* than to *vincta*.

Nomada (Holonomada) edwardsii Cresson

COLORADO.—Boulder, June 4, 1922, one female (F. E. Lutz).
UTAH.—Eureka, May 24, 1920, one female (Spaulding).

This seems to be an addition to the published fauna of Colorado, but is rather common at Boulder, both males and females being in my collection. There is no difference between the Boulder insect, that from Utah, and specimens from the Pacific Coast. There would appear to be a certain faunal continuity between northern Colorado and the West Coast by way of Idaho, Montana, Utah, and Wyoming.

HEMINOMADA Cockerell

Antennal joint 3 in both sexes usually shorter than 4, apex of male notched, both sexes usually with continuous yellow abdominal bands.

MALES

1.—Antennal joint 3 very short, not over one-third as long as 4; no supraclypeal mark..... *fragilis* Cresson.
Antennal joint 3 more than one-third as long as 4, usually about half as long...2.
2.—Yellow spots on propodeum; mesonotum entirely black; all have postorbital yellow proceeding a short distance upward, more than one-third the distance up the eye; scutellum and postscutellum colored.....3.
No yellow on propodeum; usually no postorbital yellow, but if so, then mesonotum is red, or scutellum is black, or light scutellar spots are small and the postscutellum is black.....5.
3.—Basal nervure interstitial with nervulus or very slightly basad of it; lateral face-marks not proceeding to summit of eyes; pleural yellow spot extensive antero-posteriorly.....4.
Basal nervure considerably basad of nervulus; lateral face-marks proceeding narrowly to top of eye; pleural yellow spot confined to anterior. *civilis* Cresson.
4.—First and second transverse cubital nervures subparallel, making second cubital cell broad above, taller than broad; third cubital narrowed above to one-third its base, its top not much more than one-half that of second cubital; legs yellow and black, little red except basally..... *ornithica* Cockerell.

Second cubital cell more narrowed above, produced at its lower inner angle; third nearly as wide above as second; legs red with little yellow except on coxæ and front of anterior legs..... *crawfordi* Cockerell.

5.—No yellow on first abdominal tergite, basal half black, and a reddish medial area placed transversely; venter mostly ferruginous with obscure blackish bands, and a divided narrow yellow band on sternite 3.... *vicinalis* Cresson variety.

First abdominal segment with yellow; venter marked with yellow extensively..6.

6.—Abdominal segments 1–6 with clean-cut continuous yellow bands alternating with crisp black, segment 1 with at most a reddish interruption medially..7.

Abdominal segments with a tricolored effect of red, yellow, and black, the red interrupting the otherwise entire yellow bands, and the black at the bases of the segments..... *modocorum* Cockerell, variety *a*.

7.—Head broad; heavily pubescent, that around antennæ, vertex, dorsum of thorax, and especially on the scutellum, bright red; on cheeks, face, pleura, etc., long and white; heavy white hair behind all femora; scape yellow in front; joint 4 of antennæ elongated, twice as long as broad, and not twice as long as 3, about as long as 13..... *ednæ* Cockerell.

Head narrower; more sparsely pubescent, and all of a uniformly pale golden color; scape black with a yellowish-red stripe in front; joint 4 of antennæ not elongated to nearly twice its width, not much longer than 3.

collinsiana Cockerell.

FEMALES

1.—Ground color of head and thorax black; legs bright red with very little black behind; tubercles yellow; tegulæ and scutellum ferruginous; ferruginous pleural marks; propodeum with two small red spots; abdomen red with bright yellow bands on all but first segment, interrupted on tergite 2; length about 9 mm., slender..... *civilis* Cresson.

Ground color of head and thorax red; length at least 11 mm.....2.

2.—No yellow on propodeum; no yellow on face, or at most an orange tint; antennæ red, not darkened behind apically, nor in any other portion; abdomen with entire bands, that on first tergite pale ferruginous except small lateral yellow spots; the second tergite with a discal rectangular ferruginous stain which does not interrupt the yellow band posteriorly; tubercles and tegulæ red; length 12 mm., somewhat slender..... *collinsiana* Cockerell.

Propodeum with lateral yellow marks; face with extensive yellow markings; bands on abdominal tergites 1–6, sometimes interrupted on 1; length 11 mm., robust.....3.

3.—Scutellum red; yellow propodeal marks invade enclosure... *crawfordi* Cockerell.

Scutellum yellow; yellow propodeal marks do not invade enclosure.

luteoloides Robertson, variety.

Nomada (Heminomada) fragilis Cresson

COLORADO.—Boulder, June 6, 1922, one male (F. E. Lutz); June 7, 1922, one male (Frank B. Lutz). Plainview to Eldorado Springs, May 22, 1921, one male (Jackson).

One of these (Boulder) has fairly large scutellar spots, the others have the scutellum all black.

Nomada (Heminomada) civilis Cresson

UTAH.—Eureka, May 27, 1921, one male (Spalding).
WYOMING.—Cheyenne, June 11, 1920, one female (F. E. Lutz).

The female varies from the female described by Professor Cockerell in the Entomologist, April, 1909, in having the band on second segment entirely interrupted medially by the red, and in the scape which is not yellow in front but only a suffused orange-red.

Nomada (Heminomada) ornithica Cockerell

COLORADO.—Boulder, June 7, 1922, one male (F. E. Lutz).

This specimen has a clear-cut yellow spot at the antero-lateral corners of the mesonotum, just in front of the tegulæ. A distinctive feature is the conspicuous bell-shaped yellow mark on the first abdominal sternite. This reminds one of Cockerell's *tintinnabulum*, but in the latter the mark is on the first tergite and is black.

Nomada (Heminomada) crawfordi Cockerell

COLORADO.—Elbert, June 9–11, 1922, one male (F. E. Lutz). Jim Creek, near Boulder, June 21–23, 1922, one female (F. E. Lutz). Peaceful Valley, near Ward, July 5, 1922, one female (G. N. Strawbridge).

One of the females has the band on the first abdominal tergite complete, it being emarginate at the front medially. The other has the band divided to form lateral yellow marks.

Nomada (Heminomada) vicinalis Cresson

COLORADO.—Boulder, April 26, 1913, at *Salix*, one male (Ellis).

Nomada (Heminomada) ednæ Cockerell variety

UTAH.—Eureka, April 29, 1920, two males (Spalding).

The black marks behind the flagellum continue to the apex, the yellow dorsum of prothorax, pleural spots, and scutellar spots are absent. The basal nervure goes far basad of the nervulus.

Nomada (Heminomada) collinsiana Cockerell

COLORADO.—Boulder, April 28, 1913, at *Taraxacum*, one male (Ellis); April 27, 1913, at *Berberis*, one female (Ellis).

Nomada (Heminomada) modocorum Cockerell, variety *a*

COLORADO.—Plainview to Eldorado Springs, May 22, 1921, one male (Jackson). Boulder, May 29, 1922, one male (James Denham); June 6, 1922, four males (F. E. Lutz); June 7, 1922, one male (F. E. Lutz).

I refer these insects to this species with considerable uncertainty. They are close to *taraxacella*, but from Swenk's analysis of that species I do not believe these belong there. *N. modocorum*, on the other hand, has the basal nervure interstitial with the nervulus, while the specimens under consideration have it considerably basad. The third antennal joint is at least half as long as the fourth, the flagellum being blackened behind throughout its entire length. Some of the specimens have very small yellow spots on the apices of the scutellar lobes as mentioned by Cockerell (1911). All have the tegulæ ferruginous, the tubercles and a small irregular pleural spot yellow.

Nomada (Heminomada) luteoloides Robertson, variety

UTAH.—Eureka, May 29, 1920, three females (Spalding).

I am unable to find any secure basis upon which to distinguish these from *luteoloides*, which is an essentially eastern species. The differences are entirely those of coloration, with the exception that the Utah insects have a broader face. The specimens compared are from Wisconsin and Georgia.